SCIENTIFIC NOTE

Temperature Preferences of Two Species of *Eleodes* Beetles (Tenebrionidae).—*Eleodes longicollis* LeConte and *Eleodes obscura sulcipennis* Mannerheim are widely distributed beetles. *Eleodes longicollis* is found in Kansas, Colorado, Texas, Arizona, and northern Mexico from around sea level to elevations of about 3500 m. *Eleodes obscura* is found in Washington, Idaho, Oregon, Wyoming, Utah, Arizona, and Sonora, Mexico (Blaisdell, 1909, U.S.N.M. Bulletin No. 63, pp. 191, 426; Pallister, 1954, Amer. Mus. Novitates, No. 1697, pp. 35, 36, 42). Unlike *E. longicollis*, *E. obscura* tends to occur primarily at higher elevations. In many areas the two beetles are sympatric, occupying subarid habitats.

We obtained a sample of 30 beetles of each species from the Verde River Valley, Az., (Yavapai Co., 8 km S.E. Clarkdake, 8 Sept. 1973, elev. 1200 m) a zone of sympatry for *E. longicollis* and *E. obscura.* Our objective was to determine whether the two species had different preferences for substrate temperatures.

The beetles were kept in the laboratory in plastic shoeboxes (32 × 17 × 10 cm) and fed rolled oats. In order to minimize environmental influences and adaptation to temperatures in specific microhabitats, all beetles were kept for 7 months under a constant temperature regime of 23 ± 2 degrees C. After this adjustment period, 20 beetles of each species were tested for their temperature preferences in a linear temperature gradient box. The gradient box was constructed from sheet metal, and had length × width × height dimensions of 63 × 10 × 21 cm. The two ends of the box were rounded to eliminate angular corners. A temperature gradient was established by immersing one end of the box in an ice bath and setting the other end on an electric hot plate. Temperatures at 11 points along the floor of the box were measured with two YSI telethermometers (Model 46 TUC) and thermistor temperature probes (YSI No. 402) attached to the floor.

All observations were done in the morning under uniform, artificial illumination. For a given set of observations, the gradient box was allowed 30–40 minutes to equilibrate after the heat and cold were applied. Single beetles were introduced into the box, and were given a 10 minute adjustment period. Following this, the beetle's position with respect to the plexiglass divisions and the temperature probes was scored each minute for 10 minutes. After 10 observations, the beetle

Table 1. Observed and expected frequencies of *E. longicollis* and *E. obscura sulcipennis* at different temperatures along a temperature gradient.

	Temperatures (°C)										
Species	6.9	9.2	11.6	16.2	19.3	22.2	24.0	26.0	30.0	35.5	59.6
E. longicollis											
Observed	35	43	28	47	31	45	51	118	64	35	3
Expected	24	29	25.5	42	32	45.5	59	119	82	39.5	2.5
E. obscura											
Observed	13	15	23	37	33	46	67	120	100	44	2

was replaced by another individual, and the procedure was repeated. A total of 500 observations were recorded for each species.

A chi-square analysis of the observed and expected values shown in Table 1 resulted in a chi-square value of 36.669, with 10 degrees of freedom. This is significant at an α level of 0.001, and strongly indicates that the temperature preferences of the two species are different. Both species show a maximum preference for 26 degrees C. However, except for this similarity, the two species are quite different in their preferences. *Eleodes longicollis* shows more preference for the lower temperatures, while *E. obscura* prefers higher temperatures.

This difference in temperature preferences of the two species may be explained as an evolutionary strategy to escape inclement weather. At higher elevations, low temperatures usually signal the onset of snow and prolonged periods of cold. At lower elevations in subarid zones, this is not generally the case. However, in subarid regions higher temperatures signal the onset of conditions that may approach a thermal lethal limit for a beetle. The present data suggest that *E. longicollis* may be better adapted to lower elevations, while *E. obscura sulcipennis* may be better adapted to higher elevations.—C. N. Slobodchikoff and D. Pedersen, *Department of Biological Sciences, Northern Arizona University, Flagstaff 86001.*

Simple Arthropod Activity Monitor.—The principle of an arthropod's (or other small animal's) body completing a path for current flow makes possible a simple, reliable activity monitor. It is simpler and more reliable than previously used photoelectric devices (Brown, 1959, J. Ins. Physiol. 3: 125–126; Brown and Unwin, 1961, J. Ins. Physiol. 7: 203–209), actographs (Gunn and Kennedy, 1936, J. Exp. Biol. 13: 450–459; Reichle, et al., 1965, Amer. Midl. Natur. 74: 57–66), activity wheels (Kramm, 1971, Amer. Midl. Natur. 85: 536–540), and switching devices (Naylor, 1958, J. Exp. Biol. 35: 602–610).

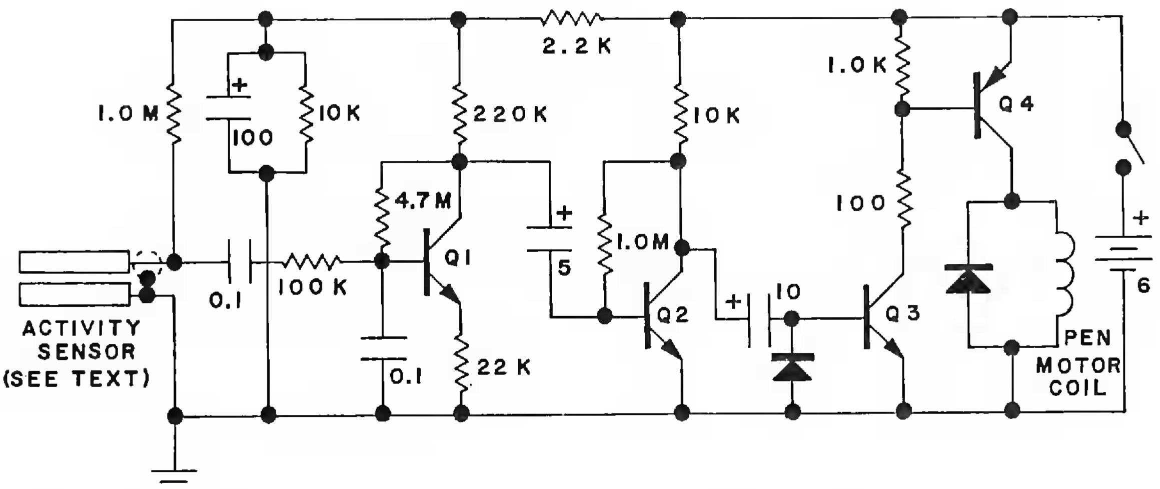

Fig. 1. Schematic diagram of the activity monitor. Resistance in ohms. Resistors ± 10% ¼ W. Capacitors in microfarads. Polarized capacitors are 10 volt electrolytics; others disc ceramic. Diodes 1N756. Transistors: NPN 2N3707; PNP 2N1305. Battery 6 volt (Burgess F4M). Parts available from Neward Electronics, 500 Pulaski Road, Chicago, Ill. 60624 or Allied Electronics, 2400 W. Washington Blvd., Chicago, Ill. 60612.